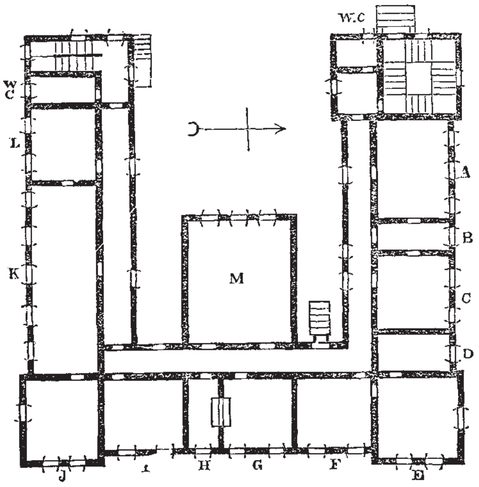
are performed in this room. Rooms F, G, and H are devoted to experimental physiology, and are furnished with operating tables, with bellows attached for keeping up artificial respiration on curarised animals, registering apparatus of various sorts for recording the pressure of the blood, water baths where any required temperature may be kept up indefinitely, an injecting apparatus like that in the microscopical department, evaporating closets, glass cases for apparatus, &c. Between Rooms G and H is a small closet arranged for observations with the spectroscope. Room I is the chamber where all experiments are performed which require the use of large quantities of quicksilver. It contains two quicksilver pumps for extracting gases from fluids, instruments for measuring the activity of the respiration in man and the lower animals, &c. Room J is divided into two portions, one of which is used for a weighing room, and the other for experiments in acoustics. Rooms K and L contain, besides the ordinary furniture of chemical laboratories, the ingenious air-pump of Bunsen, by which the process of filtering is so greatly accelerated. The lecture room, M, accommodates about one hundred students. Tables running on a small railroad in front of the seats, enable the lecturer to demonstrate his experiments very conveniently. The room is lighted from above as well as from the side, and if necessary, can be darkened completely for optical experiments. In the basement of the building is a small gas-engine of about one-horse power, which drives the respiration apparatus, registering instruments, &c. In the basement are also the rooms where the animals are kept (one room being devoted entirely to frogs), a chamber furnished with refrigerators for performing chemical experiments, where a low temperature is required, a chamber containing furnaces for fusion, a workshop, store-rooms, &c.



"The second story of the building contains the rooms of Prof. Ludwig and his family, and those of other persons connected with the laboratory. In the court-yard is a small building containing the necessary arrangements for experimenting on horses and other large animals. Here, also, are an aviary and a small fish-pond.

"Besides the permanent and stationary apparatus already described, the laboratory is well supplied with all sorts of instruments for physiological experiments, and new apparatus is constantly ordered for special investigations. There is also a very skilful mechanic living in the laboratory, whose duty it is to make alterations or repairs in the apparatus as circumstances may require.

"Prof. Ludwig directs personally all the work done in the laboratory, devoting his whole time to the superintendence of his pupils, and making no independent investigations. Each of the pupils, at present nine in number, makes, under the direction of the Professor, a series of experiments with a view of settling some special point in physiology. The results arrived at are published at the end of the year, sometimes under the names of the Professor and pupil together, and sometimes under that of the pupil alone. The whole work of the laboratory forms every year a pamphlet of 150 to 250 pages.

"Prof. Ludwig lectures five times a week on physiology, and his assistants, viz., Prof. Schweigger-Seidel in microscopy, Dr. Hüfner in chemistry, and Dr. J. J. Müller in physics, also lecture on their specialties, besides superintending the work done in their respective departments.

"It will thus be seen that abundant facilities are here offered, not only for learning the existing state of physiological science, but also for becoming familiar with the manner in which physiology is at present studied in Germany. The patient, methodical, and faithful way in which the phenomena of life are investigated by the German physiologists not only inspires great confidence in their results, but encourages one in the hope that the day is not far distant when Physiology will take its proper place as the only true foundation of Medical Science.

"H. P. BOWDITCH."

Dr. Bowditch adds to this in a private note that *all* expenses, even down to the frogs used for experiments, are borne by the Saxon Government; so that the institution is absolutely free of charge to the student. Professor Ludwig welcomes to the laboratory any student—provided there is room for him—whether German, English, French, or Russian, who is desirous and capable of original investigation.

PALÆONTOLOGY OF MAN

Précis de Paléontologie Humaine. Par le Docteur E. J. Hamy. 8vo. (Paris, 1870. London: Williams and Norgate.)

M. HAMY'S Palæontology of Man, written with the view of bringing the results of recent discovery to bear on the antiquity of our species, is a most important contribution to the rapidly increasing literature of prehistoric archæology. It is intended to serve as an appendix to Sir C. Lyell's great work on the subject, and treats only of palæolithic man to the exclusion of the three newer prehistoric ages. M. Hamy has classified his materials with judgment and caution, and has collected into a small compass most of the statements on record of the existence of man in the geological past, with a running criticism, which sometimes admits, and at other times rejects, the testimony. He stands almost alone among his countrymen in attaching no importance to the reputed discovery of the famous Moulin Quignon jaw, and in allowing that the circumstances under which it was found were, to say the least, very equivocal. His book, in a word, is so good that I propose to draw attention to a few of the weak rather

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than the strong points. Among the latter, the first chapter, which treats of the employment of stone implements in the religious ceremonies of the ancients, and gives the history of "thunderbolts," is perhaps that which especially demands the notice of the English reader.

The evidence adduced by M. Bourgeois of the discovery of flint flakes and scrapers in the Miocene strata of Thenay, along with remains of the hornless rhinoceros and mastodon, proves, according to M. Hamy, that man was an inhabitant of Miocene Europe. It is, however, rejected by most of the French and English *savants*, because M. Bourgeois has not shown that the implements in question may not have been derived ultimately from the surface of the ground, where they are very abundant. While M. Hamy acknowledges this to be the case, he does not see its full bearing on the value of the testimony. The implements probably are of Quaternary, or even of post-quaternary age, and certainly cannot be considered decisive of the sojourn of man in Europe during the Miocene epoch, although the climate at the time was almost tropical, and the conditions of life easy. Nor can the evidence of the grooved bones of Halithere, found by M. Delaunay at Puancé in Maine-et-Loire be accepted, because it cannot be proved that the grooves may not have been caused by some other agency than that of man. The proof of the existence of man in Europe during the Pliocene epoch derived from the striæ in the fossil bones found at Saint Prest and in the valley of the Arno, accepted by M. Hamy, is equally unsatisfactory. The flint "arrow-head" (fig. 25) and other rude fragments said to have been obtained at the former place from the same horizon as the bones of *Elephas meridionalis*, by M. Bourgeois, the stout champion of Miocene man, do not afford the precise and exact testimony which is demanded for the establishment of the case. The presence, indeed, of man in Europe in the Miocene and Pliocene epoch is as yet non-proven, and we must be content to await future discoveries. The results of the labours of archæologists and geologists throughout Europe during the last ten years has not placed the advent of man further back than the river gravels of the Somme, and the epoch of the caves, both of which are post-glacial or post-pliocene, or quaternary, in other words posterior to the great submergence and refrigeration of northern Europe, through which many of the Pliocene mammalia were destroyed.

M. Hamy has done good service to the students of the Quaternary epoch by refusing to allow the validity of M. Lartet's divisions into the age of extinct animals, as distinguished from that "of those which have migrated." The intimate association of the remains of the two groups in the caves and in the river-deposits, renders such a division untenable. He also modifies the divisions of the Quaternary invented by M. Lartet—(1) the age of the cave-bear, (2) that of the mammoth and woolly rhinoceros, (3) that of the reindeer, and (4) that of the aurochs, by running the first and the last two into two groups, connected together by a series of transitions. In other words, in the application of M. Lartet's system, he finds it necessary to admit that the "ages" are more or less connected together, and have no very great value in classification. M. Lartet was undoubtedly correct in the view that the post-glacial or Quaternary mammals did not arrive in Europe *en masse*, but he has not shown us the order of their appearance, which is the very corner-stone of his system. So far as the geological evidence goes, the aurochs was probably living in the Val d'Arno in the Pliocene age, and the reindeer is found as abundantly in France, Germany, and Britain with the cave-bear as with the mammoth and woolly rhinoceros. Since, indeed, the Quaternary epoch succeeded the great lowering of temperature, it might, *a priori*, be inferred that the reindeer was one of the first animals to invade the then almost arctic regions of Central and Northern Europe. The caves, however, and the river-deposits, reveal nothing on this point; they merely prove beyond a doubt that all the Quaternary mammals were living here at the same time. It is very hard to understand why M. Lartet should have expected to find all the species of animals in one locality, and should have based his classification on the absence of some, and the presence of others, since in every living fauna the animals are unequally distributed. Nor is there any intelligible cause why some few animals should be picked out of a large fauna to the prejudice of the rest, for classificatory purposes. The Essay on the Post-glacial Mammals of Great Britain (Quart. Geol. Journ. 1869) demonstrated that the system will not apply to the British Fossil Mammalia, and M. Hamy's book implies that it is equally inapplicable to those of France, for which it was intended. It is not too much to say that our present knowledge forbids any attempt to subdivide the Quaternary epoch by an appeal to the animals living at the time. Archæologists may perhaps be able to classify the different forms of implements, but naturalists are as yet unable to learn the order in which Quaternary mammalia invaded Europe. The reindeer is quite as likely to have preceded as to have succeeded the mammoth.

W. BOYD DAWKINS

COOKE'S CHEMICAL PHILOSOPHY

First Principles of Chemical Philosophy. By Josiah P. Cooke, Jun., Erving Professor of Chemistry and Mineralogy in Harvard College. Pp. 533. (Macmillan and Co., London and Cambridge, 1870.)

THIS book is intended to be used by students who have attended lectures on experimental chemistry, or after a course of laboratory instruction; hence it deals merely with the theoretical principles of the science and their application for the solution of many practical problems of chemical research.

Every chapter and section is followed by a series of problems and questions which the student is recommended carefully to work out, and anyone who has mastered all the problems set forth will have attained a very considerable proficiency in chemical science.

In the introductory chapter we have definitions referring to volume and weight, and the author has adopted here, as in several other instances, different kinds of type in order to represent different relations. Thus, Sp. Gr. in italics means specific gravity referred to water as unity; the same symbol in ordinary Roman letters signifies that hydrogen is taken as the standard; and when printed in Old English type that air = 1. The distinctions between chemical and physical forces are here pointed out.

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